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COLUMN FLOTATION SEPARATION

OF HIGH SULPHUR COAL IN

A TWO INCH PILOT COLUMN

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CONCLUSIONS

Devco coal was tested in the 2" flotation column at the pilot plant of the Centre de Recherches minerales of the Government of Quebec in Quebec City.

It was rapidly apparent that the column could obtain very high recoveries while producing a coal concentrate containing 7.5% Ash (average of all concentrates produced during this work).

With the exception of lower pH, nothing seems to stop the coal from floating. Investigated were:

Flotation Air

Feed Density

pH

Capacity

Only lowering the pH to 6.0 and below had any adverse effect on recovery.

Fuel oil was required as a reagent in the Quebec City tests and this is thought perhaps due to the Quebec City water or to a slight oxidation of the feed samples. If the Devco plant does not need fuel oil on fresh feed, the column would not need it.

As fuel oil is actually a collector for pyite, its use has probably caused a greater incidence of fine pyrite in the column concentrate.

A reverse float was tried where pyritic sulphur is floated from the coal concentrate. It works well and liberated pyritic sulphur can readily be removed from these coal concentrates with little loss of coal.

RECOMMENDATIONS

No problems are anticipated with a 72" flotation column at the Devco Victoria Junction coal preparation plant.
High Recovery would be obtained in this unit.
If fuel oil is not required when using fresh feed (as is the case now at the plant), the column would produce a concentrate lower in Ash than the 7.5% produced in all the runs shown in this report.

A conditioner would be an essential part of this column package. It would be needed if fuel oil is required and would also be needed for the pyritic sulphur float.

The automated column would provide exact control over operating parameters.

A. OPERATION & SAMPLING

Feed was drawn from the mixing tank, put into the column conditioner and diluted to the desired density. Reagents were added and the feed and underflow pumps started.

The column was run for at least 20 minutes prior to sampling in order to allow the unit to come into equilibrium.

Timed samples of overflow and underflow would be taken simultaneously. A feed grab sample would be taken from the column conditioner.

Because of the coarseness of the feed, all samples were split into three fractions:

+28 Mesh
+48 Mesh
-48 Mesh

All samples were weighed, split into the above fractions, filtered, dried, the dry fractions weighed, and prepared for assay.

As the overflow and underflows were obtained as timed samples, they can be used for material balances and to obtain the percent weight floated.

All operating conditions, structures, assays and calculated assays are shown in TABLE I.

B. CHEMICALS

I. MIBC

Considered to be a collector for coal this frother has another function in the column. It is a surface tension regulator and is used to regulate bubble size in the column. Addition is on the basis of volume per volume (cc/liter). The same amount of frother is used per unit volume of feed regardless of the percent solids.

II. FUEL OIL

The chemistry of flotation is the same in the column as in the conventional cells. However, in the work carried out in Quebec City, fuel oil was needed to obtain high recovery in the +28 and +48 mesh fractions. This could be due to the Quebec City water (TABLE II). Another possibility is that the coal may have oxidized slightly and required a bit of fuel oil to properly float it.

The use of fuel oil resulted in a dramatic increase in recovery in the +28 and +48 mesh fractions.

Something was seen in this work that had never occured before. Without sufficient fuel oil, a secondary interface would appear toward the top of the column and slowly move down the column. This secondary interface is shown in Pictures 1 and 2. It is not the usual interface used in the cleaning section. The blackish material

above it is mainly +28 and +48 mesh coal (see closeup in Picture 3). It is floatable enough that the bubbles are constantly picking it up, but it is not floatable enough to remain attached to the bubbles and be carried out the top of the column.

The column tails remain good until this secondary interface goes right out the bottom. At this point the tailings become poor with much coarse coal.

The addition of fuel oil to the column conditioner is followed in 4-5 minutes by a change in this secondary interface. It moves up the column to merge with the primary interface in the cleaning section.

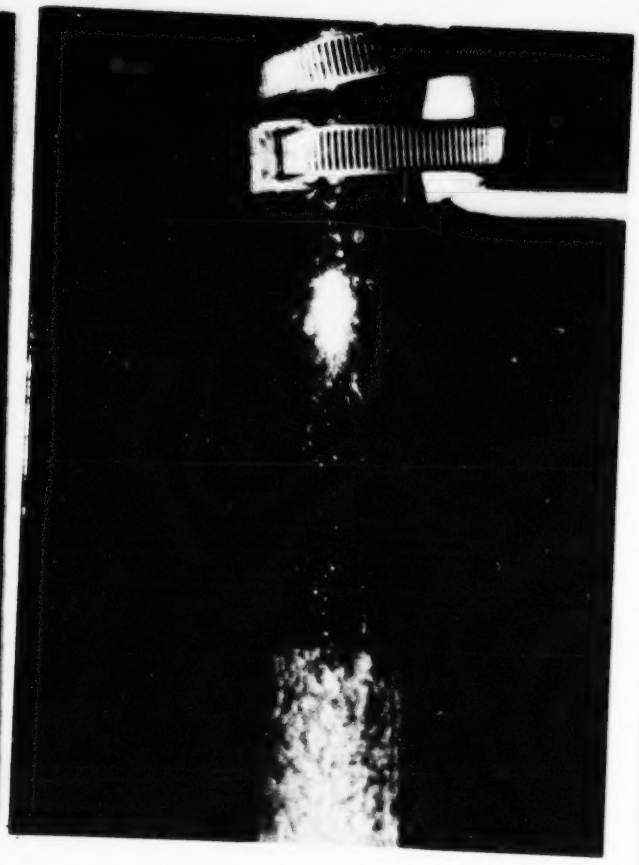
THE COLUMN WAS LITERALLY TELLING US THAT THERE WAS NOT ENOUGH REAGENT.

One drawback to the use of fuel oil is that it is a collector for pyrite.

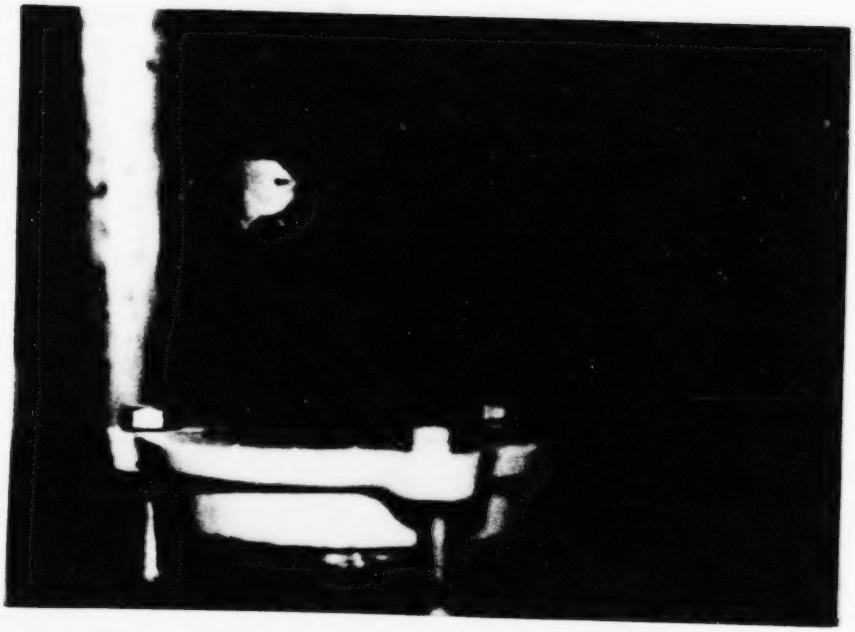
III FERRIC SULPHATE

It was suggested that the addition of ferric sulphate at pH 6.0 might help depress pyrite. This was tried in Run 21. The column tails became dark brown and recovery dropped. Subsequent work on the effect of pH showed this drop in recovery to be caused by the pH of 6.0 and not by the ferric sulphate.

Picture 1
Secondary interface



Picture 2
Secondary interface



Picture 3
Material above secondary interface

C. FEED

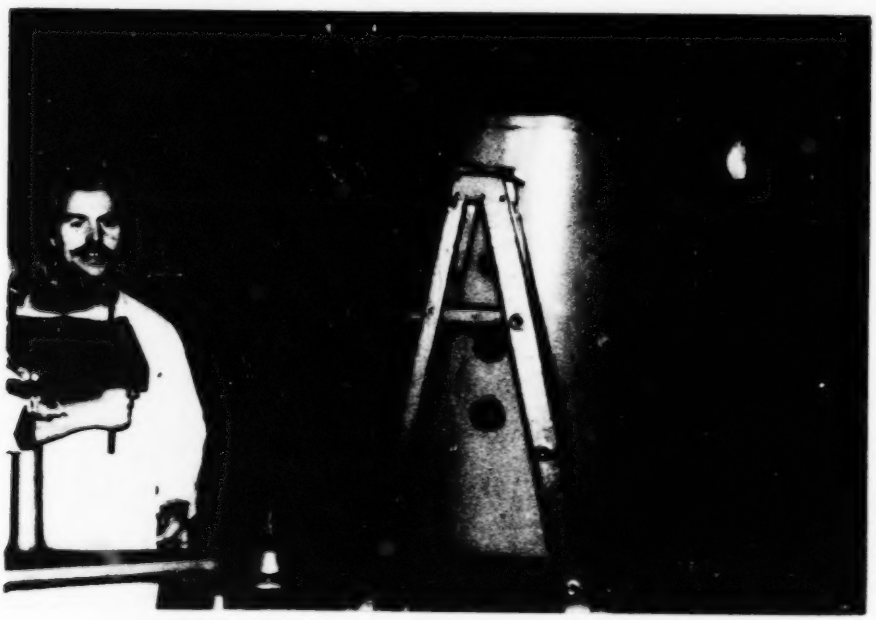
The flotation circuit of the Victoria Junction plant operates on feed of approximately 10% solids by weight.

Over a period of time, six 45 gallon drums of solids were obtained by taking samples of this low density feed and allowing the solids to settle. The water was decanted and the procedure repeated. The drums contained approx 75% solids.

Drums 1 and 2 were shipped Jan. 15/82, while 3,4,5 and 6 were shipped Jan 20/82.

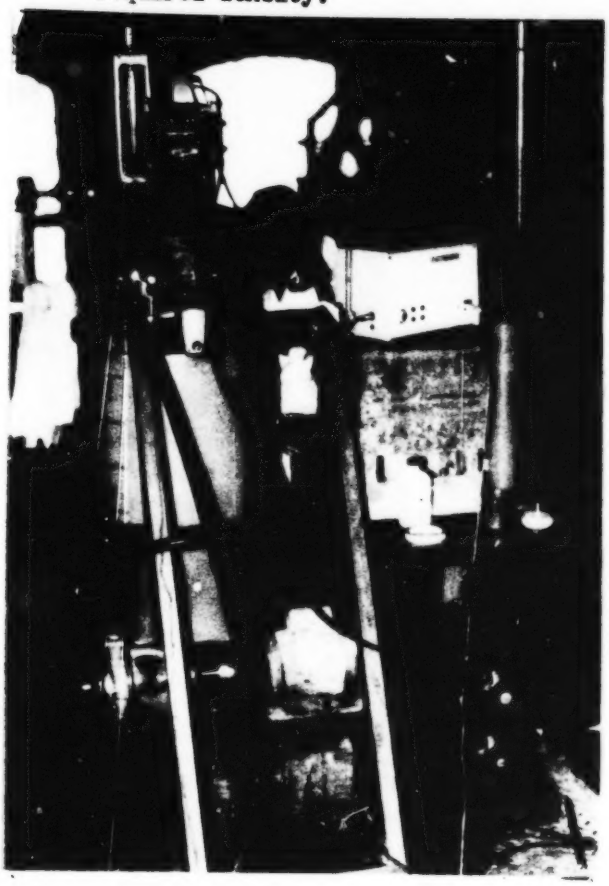
Unfortunately, many fines were lost in the decanting and the feed used in this work was much coarser than usual (TABLES V & VI).

A barrel of feed would be placed in the mixing tank shown in Picture 4 and diluted to 40-50% solids. Feed from this tank would



Picture 4
Primary mixing tank

be put in the column conditioner (Picture 5) and diluted to the required density.



Picture 5
Column conditioner

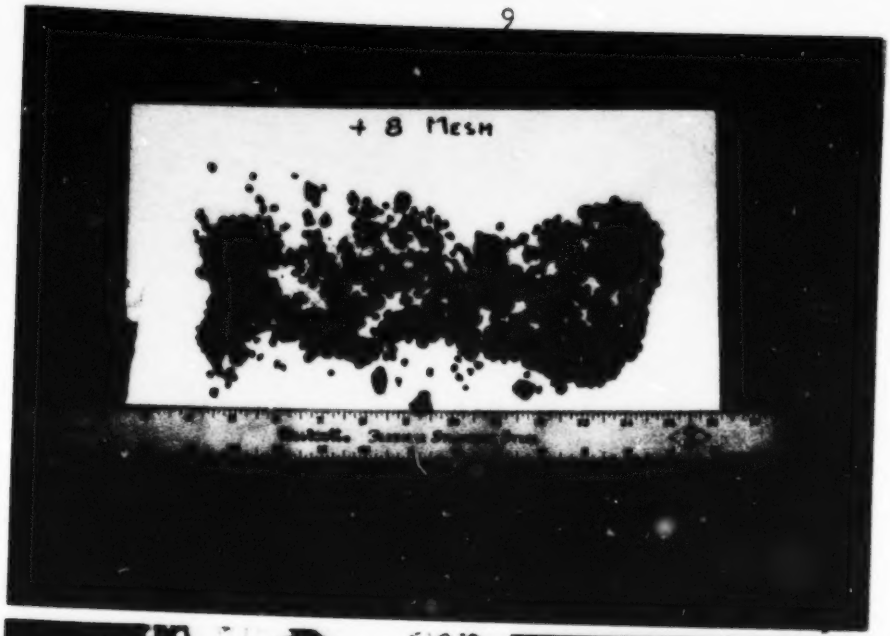
Apart from being coarser than normal flotation feed, it also contained large pieces of coal and refuse. This was quickly learned in the first run when both feed and underflow lines plugged. The material remaining in the column conditioner was passed through an 8 mesh screen. Particles as large as ½" were left on the screen (Picture 6).

Runs 2-8 inclusive were carried out on -8 mesh feed.

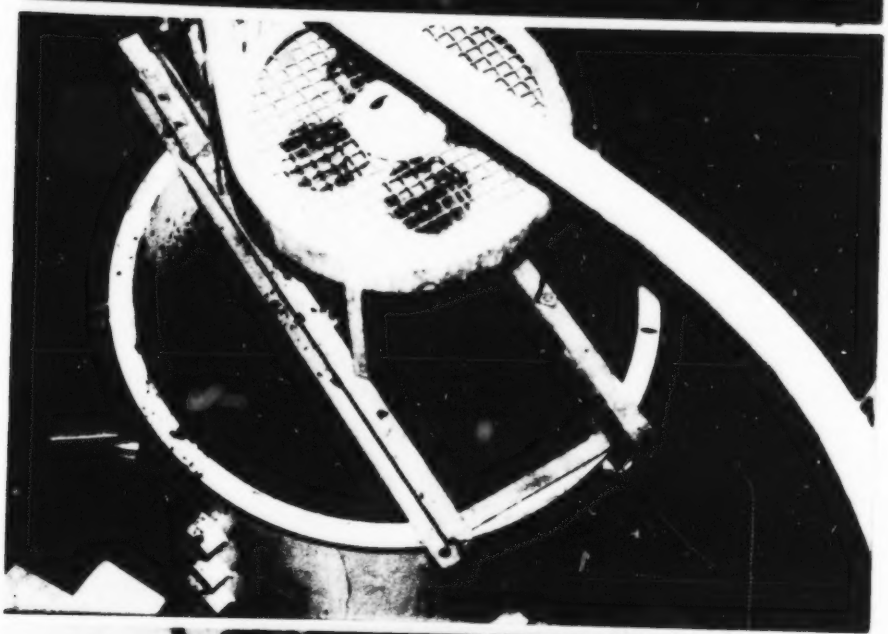
Run 9 was on -28 mesh feed.

Starting with Run 10, all feed was passed through a 20 mesh Sweco vibrating screen.

The coarseness of the feed led to problems in the mixing tank



Picture 6
+8 Mesh feed



Picture 7
Agitation in
Mixing tank

Picture 8
Agitation in
column conditioner

and in the column conditioner. From an appearance viewpoint, both mixers appeared to be doing a good job of keeping everything in suspension (Pictures 7 & 8). Feed was drawn from the bottom of both tanks and in each the amount of coarse material decreased as the slurry level dropped.

In the mixing tank this was seen in a decrease in the amount of coarse rejected by the Sweco vibrating screen. Samples taken from this tank for sieve analyses are shown in TABLES V & VI. Ash assays average approx 30% vs an average of 22,2% Ash for all the individual column feed samples. The coarse (which is higher in coal) was not getting to the surface where the samples were taken.

In the column conditioner this resulted in a finer feed and also lower percent solids in the feed as the slurry level dropped. Dual impellers together with a recirculation pump were used. Even with this arrangement, the coarse content was higher at the bottom of the conditioner.

I. MAGNETITE

There was a fair amount of fine magnetite in the flotation feed because of deficiencies in the magnetite recovery section of the Victoria Junction plant.

Holding a magnet to the side of the column resulted in the condition shown in Picture 9 within a second or two.

Some barrels held more magnetite than others. Run 27, Time 1145 was prepared by passing the feed through the Sala laboratory magnetic seperator held by the man in Picture 4. No change in results was noted.

Picture 9
Magnetite

D. FEED DENSITY

The flotation column has been used to float coal in the U.S.A. at two different plants. Although both plants mine their coal from the huge Pittsburg seam (which underlays a large portion of Pennsylvania, Ohio and West Virginia), they are seperated by 50 miles.

At both locations, the coal would stop floating in the column once the feed density exceeded 10-12% solids.

This did not occur with the Devco coal. Feed % solids were

varied between 10 and 32.5%. No noticeable difference in recovery occured (TABLE VII).

If higher density feed can be obtained, the column capacity for a fixed retention time would be increased by a factor of three.

E. pH

pH variation from 7.0-10.0 has no effect on results. However, pH of 6.0 and lower reduces recovery. Normal operation produces a column tailing that is light beige in color (Picture 9). At pH 6 and lower, the bottom of the column becomes dark brown and the coal content of all sizes in the tails increases drastically. (TABLE VIII)

F. AIR

Most runs were carried out at an air consumption of 4.0 scfh.

Air usage of 2.0-5.0 scfh was tried. No effect on results was noted (TABLE IX).

G. CAPACITY

While the commercial columns produce the same concentrate and tailings as the 2" column, scaleup factors on capacity between the small unit and the large ones are not known at this time.

A fellowship has recently been granted at McGill University for

doctorate work on column flotation. Scaleup factors are to be a major area of investigation.

Normally, no attempt is made to determine the capacity of the small column. Feed rates are set at 900 ml/min and are kept there.

A series of runs with feed rates up to 1470 ml/min (the upper limit of the feed Pump) were carried out. No changes in results were noted.

H. BUBBLER

When the 2" column was purchased by Quebec in 1968, it was supplied with a rubber bubbler. Runs 2 and 4 were done with this bubbler. As it was 14 years old, it was changed for the stainless steel type used in the CANMET column and all other runs were done with this bubbler.

On the last day, Run 41 was done normally with the stainless bubbler. The rubber bubbler was replaced for Run42. This bubbler is still good as there was no change in results.

I. PYRITIC SULPHUR FLOAT

The U. S. Bureau of Mines has developed a float whereby fine pyritic sulphur is floated from coal flotation concentrates. The normally floatable coal is depressed with a hydrophilic colloid and a xanthate is used to float the pyrite

Eight 5 gallon pails of Devco coal concentrate were sent to Quebec. Each pail only contained three gallons and since the column uses approx one liter of feed per minute, there was not sufficient material to do much work - even diluting the feed to 5% solids to obtain greated volume.

By the time this material had been used up, something had been learned of this float. It is a touchy float in that small changes in reagent produce large changes in results.

The depressant, Aero 633, quickly stops the coal from floating. It also destroys the frothers ability to regulate bubble size. Thus, you must add more frother which in turn makes some of the coal floatable.

The collector, potassium amyl xanthate (PAX), also has frothing tendencies and this too renders some of the coal floatable.

Any increase in PAX or MIBC leads to coal losses. This has to be counterbalanced with an increase in 633 to stop the coal from floating.

As there was still barrel No 6 remaining of the original flotation feed, it was used to produce more coal concentrate. Half of this barrel was passed through the column in Run 37 and the concentrate produced was collected for the feed used in the reverse floats shown in TABLE XI.

In these runs, the tailing is the float product. It is a typical

sulphide float in that the float product is all -48 mesh. As fuel oil had been used to produce the feed for these tests, it appears that the pyrite content of the -48 mesh fraction of the feed is higher than normal (over 3% S).

The xanthate removed 60-70% of the total sulphur content of the -48 mesh fraction.

Careful control of collector, depressent and frother is needed to obtain good sulphur removal with low coal losses.

The commercial columns, where the feed volume is measured, would be ideally suited for the automatic regulation of these reagents.

TAB
RES

OPERATING CONDITIONS

Run	Time	Barrel #	Temp °C	pH	Air scfh	% Solid	MIBC gm/l	F.Oil #/ton
2	1120	1			4.0	10	0.0074	—
4	1545	1			4.0	10	0.0114	—
5	1045	1			4.0	10	0.0072	—
5	1115	1			4.0	10	0.0112	—
6	1400	1			4.0	10.5	0.0109	—
6	1430	1			4.0	10.5	0.0150	—
6	1515	1			4.0	10.5	0.0210	—
6	1550	1			4.0	10.5	0.0210	0.9
7	945	1			4.0	10	0.0071	—
7	1025	1			4.0	10	0.0071	0.36
7	1105	1			4.0	10	0.0112	0.36
7	1145	1			4.0	10	0.0112	0.54
8	1435	1		7.4	4.0	18.5	0.0111	0.5
8	1505	1		7.4	4.0	18.5	0.0111	0.75
9	1015	2		7.8	4.0	21.5	0.0109	—
9	1040	2		7.8	4.0	21.5	0.0109	0.5
10	1400	2		7.9	4.0	19.5	0.0110	0.25
10	1405	2		7.9	4.0	19.5	0.0110	0.25
10	1435	2		7.9	4.0	19.5	0.0110	0.5
11	950	2			4.0	10.5	0.0079	—
11	1045	2			4.0	10.5	0.0079	0.5
11	1145	2		2.7	4.0	10	0.0079	0.5
12	1420	2		7.7	4.0	15	0.0079	0.5
12	1505	2		7.7	2.0	15	0.0079	0.5
12	1609	2			4.0	15	0.0079	0.5
13	955	2		7.3	4.0	20	0.0079	0.5
13	1030	2		7.3	4.0	20	0.0079	0.75
14	1430	3			4.0	20	0.011	—
14	1445	3			4.0	20	0.011	—
14	1510	3			4.0	20	0.011	0.75
15	1020	3	19	7.8	4.0	15	0.0107	0.5
15	1050	3	19	7.8	4.0	15	0.0107	0.75
16	1350	3	16	7.8	4.0	16	0.0076	0.5
16	1445	3	16	7.8	4.0	16	0.0076	0.75
17	950	3	20	7.8	4.0	20	0.0076	0.5
17	1030	3	20	7.8	4.0	20	0.0117	0.5
18	1030	3	19	7.7	4.0	15	0.011	0.5
19	1550	3	23	7.8	4.0	30	0.011	0.75

FEED

+28 Mesh			+48 Mesh			-48 Mesh			Total	Total
% Wt	% Ash	% S	% Wt	% Ash	% S	% Wt	% Ash	% S	% Ash	% S
									2.6	2.10
7.2	17.1	1.44	32.9	13.9	1.87	59.9	26.3	2.58	21.6	2.26
									21.2	2.12
3.4	14.3		27.8	12.0		68.8	23.6		20.1	
									21.2	1.84
5.3	20.3	1.64	38.2	18.3	2.44	56.5	27.6	1.75	23.8	2.01
5.7	13.6	1.52	38.7	10.6	1.55	55.6	27.8	2.44	20.3	2.04
3.5	8.83	1.19	27.3	2.81	1.12	69.2	17.1	1.69	18.9	1.52
8.7	19.6	1.67	32.5	14.2	1.64	58.8	29.9	2.52	23.9	2.16
4.4	7.48	1.24	25.0	3.13	1.18	70.6	21.4	1.77	16.2	1.60
6.8	5.10	1.30	34.4	5.23	1.32	58.8	24.8	2.04	16.7	1.74
9.4	16.4	1.59	41.9	13.4	1.73	48.7	31.7	2.38	22.6	2.03
6.6	5.31	1.38	38.8	6.56	1.37	54.6	26.4	2.04	17.3	1.74
8.9	7.60	1.68	37.8	15.8	1.82	53.3	40.8	2.47	28.4	2.06
5.9	6.47	1.48	29.1	5.71	2.20	65.0	32.7	1.40	23.3	1.58
5.8	13.3	1.59	34.6	8.06	1.74	59.6	35.0	2.38	24.4	1.84
6.4	5.54	1.34	32.7	3.84	1.43	60.9	26.7	2.11	17.9	1.84
8.6	19.7	3.41	34.0	15.0	1.67	57.4	39.8	2.80	29.6	2.43
5.5	3.70	1.50	29.5	7.99	1.43	65.0	29.4	2.02	21.8	2.56
8.8	12.4	1.74	33.0	11.8	1.69	58.2	39.8	2.31	28.1	2.06
4.5	2.27	1.38	26.6	5.79	1.32	68.9	27.7	1.88	20.7	1.77
5.4	5.81	1.45	35.0	9.62	1.70	59.6	34.8	2.49	24.3	2.10
6.1	11.9	1.36	33.0	5.72	1.44	60.9	35.8	2.00	24.4	1.78

Cond

+28 Mesh			+48 Mesh		
% Wt	% Ash	% S	% Wt	% Ash	%
0.3	---	---	15.5	2.17	1.
1.4	1.82	1.03	40.2	2.14	1.
	---	---	1.5	5.41	--
4.4	1.99	1.08	52.6	3.42	1.
1.3	2.16	1.01	30.3	2.03	1.
7.0	1.81	1.11	66.0	3.02	1.
1.8	1.76	1.01	52.5	3.14	1.
4.7	1.79	1.04	58.4	4.17	1.
8.4	6.21	1.60	53.6	3.33	1.
9.9	3.21	1.72	49.2	6.82	2.
14.1	3.33	1.68	52.0	7.56	2.
8.3	2.86	1.41	51.1	5.76	1.
11.7	3.88	1.66	53.2	6.59	2.
6.3	3.70	1.34	48.8	4.31	1.
2.2	1.35	1.10	49.9	3.71	1.
8.9	3.34	1.44	54.4	5.67	1.
7.8	3.51	1.43	61.7	7.11	2.
12.1	2.66	1.39	69.3	6.47	2.

See TABLE III f

ABLE I

RESULTS

| Concentrate | | | | | | Tailings | | | | | |

TABL
Resul

Operating Conditions									Feed										Concent					
									+28 Mesh			+48 Mesh			-48 Mesh				+28 Mesh			+48 Mesh		
Run	Time	Barrel #	Temp °C	pH	Air scfh	% Solids	MIBC gm/L	F.Oil #/ton	% Wt	% Ash	% S	% Wt	% Ash	% S	% Wt	% Ash	% S	Total % Ash	Total % S	% Wt	% Ash	% S	% Wt	% Ash	% S
20	1015	4	12.5	8.2	4.0	18	0.011	—	8.0	24.7	1.78	42.3	20.8	2.03	47.9	36.4	2.75	28.9	2.37	9.7	4.42	1.72	62.1	4.61	2.30
20	1110	4	12.5	8.2	4.0	18	0.011	0.5	4.9	8.33	1.55	31.8	6.72	1.56	63.3	20.4	2.36	19.3	2.07	7.6	4.39	1.65	46.4	9.35	2.10
20	1155	4		8.2	4.0	15.5	0.011	0.5	9.8	30.7	2.23	45.0	20.5	2.43	45.2	31.2	3.18	26.3	2.75	8.3	3.00	1.80	53.1	6.00	2.37
21	1445	4	12	6.0	4.0	17.5	0.011	0.5	8.5	20.7	1.95	39.1	18.2	2.19	52.4	37.2	3.01	28.4	2.60	0.8	2.61	1.19	58.8	6.25	2.33
21	1540	4	12	5.9	4.0	17.5	0.011	0.5	5.1	15.5	1.39	30.5	6.87	1.45	64.4	29.2	2.05	21.7	1.83	2.8	3.04	1.17	48.9	3.43	1.63
22	945	4	16	8.0	4.0	17.5	0.011	0.33	7.5	17.2	1.68	38.5	17.1	2.83	54.0	36.0	2.91	27.3	2.79	9.2	2.93	1,76	60.1	8.61	2.02
22	1020	4	16	9.0	4.0	17.5	0.011	0.33	6.5	5.35	1.65	33.7	8.05	1.68	59.8	31.4	2.41	21.8	2.11	11.6	2.88	1.63	54.8	8.21	2.50
22	1050	4	16	10.0	4.0	17.5	0.011	0.33	4.1	5.42	1.36	31.6	3.94	1.39	64.3	25.4	2.16	17.8	1.88	6.7	2.27	1.33	51.2	4.67	1.84
23	1515	4	11.5	7.6	4.0	16.5	0.011	0.33	2.3	36.6	1.86	30.2	13.4	1.78	67.5	31.1	2.53	25.9	2.29	1.7	3.86	1.51	56.4	4.97	2.04
23	1535	4	11.5	7.0	4.0	16.5	0.011	0.33	1.4	19.2	1.65	32.7	10.0	1.63	65.9	30.5	2.30	23.6	2.07	—	—	—	35.1	4.38	1.70
23	1600	4	11.5	6.0	4.0	16.5	0.011	0.33	—	—	—	25.6	4.95	1.40	74.4	23.3	1.69	18.6	1.62	—	—	—	28.6	7.46	1.41
24	1000	4	14	7.8	4.0	15	0.011	0.33	3.1	24.1	2.16	36.6	12.5	1.81	60.3	32.0	2.41	24.6	2.18	2.9	4.56	1.72	65.1	8.34	2.48
24	1048	4	14	7.8	2.9	15	0.011	0.33	8.3	13.5	1.65	37.3	12.0	1.85	54.4	30.9	2.36	22.4	2.11	8.3	3.21	1.69	59.7	7.02	2.08
24	1120	4	14	7.8	2.0	15	0.011	0.33	..	..	..	11.8	5.65	1.31	88.2	17.9	1.30	16.5	1.30	3.5	2.78	1.35	45.2	3.56	1.52
25	1405	4	16.5	8.1	2.0	15.5	0.011	0.33	2.7	14.1	1.60	43.5	9.20	1.68	53.8	30.7	2.22	20.9	1.97	2.4	3.32	1.60	59.4	5.81	1.76
25	1440	4	16.5	8.1	4.0	15.5	0.011	0.33	5.6	15.2	1.72	40.1	9.80	1.62	54.3	29.5	1.83	20.8	1.74	8.2	3.11	1.68	56.5	6.68	2.08
25	1515	4	16.5	8.1	5.0	15.5	0.011	0.33	3.3	8.28	1.43	32.9	4.88	1.41	63.8	21.6	1.66	15.7	1.57	6.1	4.50	1.35	52.5	3.07	1.54
26	1000	5	14	8.0	4.0	15	0.011	0.33	5.0	20.4	2.04	49.2	18.0	2.08	45.8	31.4	2.54	23.6	2.19	8.8	2.75	1.76	68.3	7.01	2.34
26	1030	5	20	7.7	4.0	27.5	0.011	0.33	5.9	12.0	1.67	44.6	11.2	1.82	49.5	29.6	2.30	20.4	2.15	9.0	3.04	1.79	65.5	9.49	2.64
27	1145	5	15	7.9	4.0	15	0.011	0.33	5.6	28.9	1.87	48.3	20.5	2.40	46.4	35.4	2.90	27.8	2.60	4.1	3.52	1.76	66.7	7.14	2.67
27	1200	5	15	7.9	4.0	15	0.011	0.33	4.3	22.9	1.86	41.8	12.4	1.90	53.9	32.1	2.62	23.7	2.29	4.0	3.95	1.90	59.5	8.95	2.87
28	1420	5	17	8.0	4.0	15	0.011	0.5	3.4	22.4	1.82	42.0	12.1	2.06	54.6	34.8	2.56	24.8	2.31	4.1	3.65	1.84	68.2	10.3	3.36
28	1505	5	17	8.0	4.0	15	0.011	0.5	7.2	18.2	1.94	42.6	12.9	1.90	50.2	31.7	2.52	22.7	2.21	6.9	3.20	1.81	60.9	7.22	2.43
28	1550	5	17	8.0	4.0	15	0.011	0.7	5.8	8.22	1.83	43.1	10.6	1.92	51.1	29.6	2.31	20.2	2.11	9.2	3.02	1.81	57.8	5.50	2.22
29	955	5	15.5	7.7	4.0	11.5	0.011	0.5	4.4	20.3	1.60	37.6	11.0	1.64	58.0	32.0	2.50	23.6	2.14	5.3	3.32	1.65	52.1	6.03	2.24
29	1025	5	15.5	7.7	4.0	11.5	0.011	0.5	3.2	11.5	1.74	35.6	7.14	1.58	61.2	28.9	2.24	20.8	1.99	5.9	3.15	1.74	49.4	4.37	1.82
30	1207	5	17	8.0	4.0	32.5	0.011	0.5	5.6	6.48	1.55	34.8	6.21	1.47	59.6	27.7	1.98	19.0	1.78	4.6	2.31	1.24	57.2	3.37	1.55
32	1455	5	19	7.5	4.0	28.5	0.011	1.0	8.9	7.89	1.50	41.2	6.86	1.49	49.9	28.6	1.90	17.8	1.70	10.4	2.94	1.53	64.6	6.11	1.78
32	1525	5	19	7.5	4.0	21.7	0.011	1.21	6.4	6.29	1.47	40.4	6.20	1.43	53.2	24.5	1.81	15.9	1.64	9.4	3.80	1.61	49.8	5.80	1.74
37	Composite6		12.5	7.7	4.0	20.5	0.011	0.5	5.1	13.5	1.66	43.2	14.2	1.89	51.7	32.2	2.15	23.5	2.01	8.2	2.91	1.67	69.8	8.91	2.38
41	950	6	12	7.5	4.0	20	0.011	0.5	9.1	17.8	1.71	39.0	15.2	1.87	51.9	35.7	2.37	28.1	2.12	8.1	3.32	1.77	75.1	10.7	3.00
42	1120	6			4.0	20	0.011	0.65	6.2	10.0	1.65	35.6	7.90	1.57	58.2	31.1	2.11	20.5	1.89	7.4	2.81	1.51	61.2	6.85	2.14

See TABLE III for

LE I

ULTS

| Concentrate | | | | | Tailings | | | | |

TA
RE

Run	Time	Barrel #	Temp °C	pH	Air scfh	% Solic	MIBC gm/L	F.Oil #/ton
2	1120	1			4.0	10	0.0074	---
4	1545	1			4.0	10	0.0114	---
5	1045	1			4.0	10	0.0072	---
5	1115	1			4.0	10	0.0112	---
6	1400	1			4.0	10.5	0.0109	---
6	1430	1			4.0	10.5	0.0150	---
6	1515	1			4.0	10.5	0.0210	---
6	1550	1			4.0	10.5	0.0210	0.9
7	945	1			4.0	10	0.0071	---
7	1025	1			4.0	10	0.0071	0.36
7	1105	1			4.0	10	0.0112	0.36
7	1145	1			4.0	10	0.0112	0.54
8	1435	1		7.4	4.0	18.5	0.0111	0.5
8	1505	1		7.4	4.0	18.5	0.0111	0.75
9	1015	2		7.8	4.0	21.5	0.0109	---
9	1040	2		7.8	4.0	21.5	0.0109	0.5
10	1400	2		7.9	4.0	19.5	0.0110	0.25
10	1405	2		7.9	4.0	19.5	0.0110	0.25
10	1435	2		7.9	4.0	19.5	0.0110	0.5
11	950	2			4.0	10.5	0.0079	---
11	1045	2			4.0	10.5	0.0079	0.5
11	1145	2		2.7	4.0	10	0.0079	0.5
12	1420	2		7.7	4.0	15	0.0079	0.5
12	1505	2		7.7	2.0	15	0.0079	0.5
12	1609	2			4.0	15	0.0079	0.5
13	955	2		7.3	4.0	20	0.0079	0.5
13	1030	2		7.3	4.0	20	0.0079	0.75
14	1430	3			4.0	20	0.011	---
14	1445	3			4.0	20	0.011	---
14	1510	3			4.0	20	0.011	0.75
15	1020	3	19	7.8	4.0	15	0.0107	0.5
15	1050	3	19	7.8	4.0	15	0.0107	0.75
16	1350	3	16	7.8	4.0	16	0.0076	0.5
16	1445	3	16	7.8	4.0	16	0.0076	0.75
17	950	3	20	7.8	4.0	20	0.0076	0.5
17	1030	3	20	7.8	4.0	20	0.0117	0.5
18	1030	3	19	7.7	4.0	15	0.011	0.5
19	1550	3	23	7.8	4.0	30	0.011	0.75

OPERATING CONDITIONS

FEED

+28 Mesh			+48 Mesh			-48 Mesh			Total	Total
% Wt	% Ash	% S	% Wt	% Ash	% S	% Wt	% Ash	% S	% Ash	% S
									2.6	2.10
7.2	17.1	1.44	32.9	13.9	1.87	59.9	26.3	2.58	21.0	2.26
									21.2	2.12
3.4	14.3		27.8	12.0		68.8	23.6		20.1	
									21.2	1.84
5.3	20.3	1.64	38.2	18.3	2.44	56.5	27.0	1.75	23.8	2.01
5.7	13.6	1.52	38.7	10.6	1.55	55.6	27.8	2.44	20.3	2.04
3.5	8.83	1.19	27.3	2.81	1.12	69.2	17.1	1.69	16.9	1.52
8.7	19.6	1.67	32.5	14.2	1.64	58.8	29.9	2.52	23.9	2.16
4.4	7.48	1.24	25.0	3.13	1.18	70.6	21.4	1.77	16.2	1.60
6.8	5.10	1.30	34.4	5.23	1.32	58.8	24.8	2.04	16.7	1.74
9.4	16.4	1.59	41.9	13.4	1.73	48.7	31.7	2.38	22.6	2.03
6.6	5.31	1.38	38.8	6.56	1.37	54.6	20.4	2.04	17.3	1.74
8.9	7.60	1.68	37.8	15.8	1.82	53.3	40.8	2.47	28.4	2.06
5.9	6.47	1.48	29.1	5.71	2.20	65.0	32.7	1.40	23.3	1.58
5.8	13.3	1.59	34.6	8.06	1.74	59.6	35.0	2.38	24.4	1.84
6.4	5.54	1.34	32.7	3.84	1.43	60.9	26.7	2.11	17.9	1.84
8.6	19.7	3.41	34.0	15.0	1.67	57.4	39.8	2.86	29.6	2.43
5.5	3.70	1.50	29.5	7.99	1.43	65.0	29.4	2.02	21.8	2.56
8.8	12.4	1.74	33.0	11.8	1.69	58.2	39.8	2.31	28.1	2.06
4.5	2.27	1.38	26.6	5.79	1.32	68.9	27.7	1.88	20.7	1.77
5.4	5.81	1.45	35.0	9.62	1.70	59.6	34.8	2.49	24.3	2.10
6.1	11.9	1.36	33.0	5.72	1.44	60.9	35.8	2.00	24.4	1.78

Co

+28 Mesh			+48 Mesh	
% Wt	% Ash	% S	% Wt	% Ash
0.3	---	---	15.5	2.17
1.4	1.82	1.03	40.2	2.14
	---	---	1.5	5.41
4.4	1.99	1.08	52.6	3.42
1.3	2.16	1.01	30.3	2.03
7.0	1.81	1.11	66.0	3.02
1.8	1.76	1.01	52.5	3.14
4.7	1.79	1.04	58.4	4.17
8.4	6.21	1.60	53.6	3.33
9.9	3.21	1.72	49.2	6.82
14.1	3.33	1.68	52.0	7.56
8.3	2.86	1.41	51.1	5.76
11.7	3.88	1.66	53.2	6.59
6.3	3.70	1.34	48.8	4.31
2.2	1.35	1.10	49.9	3.71
8.9	3.34	1.44	54.4	5.67
7.8	3.51	1.43	61.7	7.11
12.1	2.66	1.39	69.3	6.47

See TABLE III

BLE I

SULTS

Concentrate						Tailings													
-48 Mesh						+28 Mesh			+48 Mesh			-48 Mesh						
% S	% Wt	% Ash	% S	Total % Ash	Total % S	% Wt	% Ash	% S	% Wt	% Ash	% S	% Wt	% Ash	% S	Total % Ash	Total % S	Yield %	% Wt Floated	Remarks
				3.88	1.80	8.6	35.8	2.30	29.4	70.1	2.40	62.0	89.4	1.69	79.1	1.95		70.7	Rubber bubbler
				4.72	1.88	13.7	35.8	2.30	40.9	70.1	2.70	45.4	89.2	2.70	74.1	2.65		53.8	Rubber bubbler
				5.54	2.42	10.7	13.9	1.88	52.9	80.4	1.84	36.4	74.1	2.92	71.0	2.24		41.5	Stainless bubbler used from here on
				6.13	2.06	21.8	8.22	1.53	41.9	10.2	1.82	36.3	91.2	3.22	37.2	2.18		80.9	
				5.43	2.04	14.5	22.6	1.86	56.2	43.3	2.34	29.3	86.3	2.27	52.9	2.24	63.8	43.7	
				5.33	2.06	15.8	7.39	1.70	31.1	34.2	2.22	53.1	90.0	1.36	59.6	1.68		70.4	
				5.03	2.11	16.0	25.7	2.04	49.4	55.0	2.64	34.5	89.5	1.72	62.2	2.23	71.0	57.8	
				14.4	2.31	4.6	31.1	2.54	20.6	80.4	2.16	74.8	90.8	1.44	85.9	1.64		84.0	
				5.03	2.08	15.1	20.8	1.84	59.2	30.8	2.18	25.7	79.0	2.94	41.7	2.33	41.1	27.4	
				6.46	2.38	17.4	4.49	1.48	34.3	17.4	2.34	48.3	87.2	2.18	48.9	2.11		63.7	
				7.28	2.38	16.4	23.9	2.14	45.8	68.2	2.86	37.8	89.9	2.72	69.1	2.69		56.9	
				7.61	2.26	8.4	7.11	2.04	11.8	57.0	2.76	79.8	90.4	1.72	79.5	1.89		80.5	
				7.39	2.24	14.4	20.0	2.02	30.8	66.4	2.64	54.8	90.4	1.54	72.9	1.95		70.7	
				7.44	2.08	10.2	8.57	1.90	11.5	52.2	2.72	78.3	91.2	1.52	78.3	1.70	82.1	83.4	
				3.21	1.53	0.2	—	—	67.4	26.7	2.27	32.4	60.5	3.27	37.6	2.59		30.8	Secondary interface out the bottom
				5.54	1.91	0.2	—	—	6.8	76.3	3.42	93.0	91.0	1.62	89.8	1.74		85.0	
				4.89	2.49	14.0	55.0	3.20	36.5	80.0	1.81	40.5	90.9	3.30	81.9	2.74	75.2	65.6	
				5.02	1.76	14.0	16.8	1.80	66.7	35.2	4.19	19.3	79.4	4.68	41.5	3.95		—	Secondary interface out the bottom
.12	84.2	6.19	2.17	5.55	2.01	7.5	17.0	3.33	9.9	64.9	2.07	82.6	91.2	1.92	83.0	2.04		83.2	
.17	58.4	8.04	2.46	5.58	1.92	18.0	20.4	2.13	57.2	37.6	2.52	24.8	84.1	2.21	46.1	2.37	60.6	40.6	
---	98.5	8.25	----	8.21	2.28	18.9	3.68	1.45	32.2	12.8	2.13	48.9	89.8	1.86	48.7	1.87	69.1	62.6	
.59	43.0	8.67	2.88	5.62	2.12	12.8	6.28	1.65	55.5	11.1	1.62	31.7	78.8	2.04	31.9	1.76		39.3	pH of 2.7
.16	68.4	8.89	2.48	6.72	2.06	25.6	26.0	2.82	30.4	56.8	5.12	44.0	89.6	2.78	63.4	3.40	68.4	60.5	
.56	27.0	6.52	2.20	3.88	1.75	15.7	4.31	1.72	49.7	10.4	1.80	34.6	76.8	3.68	32.5	2.44	63.2	47.1	Secondary interface out the bottom
.59	45.7	9.35	2.78	5.95	2.12	7.0	12.4	2.89	61.0	53.0	5.05	27.0	90.2	2.00	67.6	2.92	79.9	60.6	
.59	36.9	9.59	2.98	6.06	2.08	25.3	28.3	2.29	38.9	49.3	3.41	35.4	90.1	1.93	58.3	2.59	68.2	59.7	
.80	38.0	6.16	2.92	4.64	2.21	18.5	12.9	2.50	31.4	38.0	3.70	50.1	89.6	1.97	59.2	2.51	78.8	75.4	
						9.3	73.1	5.75	24.8	84.8	3.89	65.9	94.9	1.01	90.3	2.17	72.3	57.0	
.00	40.9	14.8	3.67	9.73	2.66	15.5	7.42	2.50	48.2	31.9	5.25	36.3	77.6	7.17	44.8	5.52		—	Secondary interface out the bottom
.52	33.9	10.3	4.71	7.89	3.14	1.8	74.8	-	11.4	84.8	1.42	86.8	95.1	1.31	93.5	1.32	83.8	76.4	
.98	40.6	12.9	3.34	8.42	2.45	9.2	50.8	4.50	22.4	82.2	3.21	68.4	94.2	0.88	87.5	1.74	79.3	67.9	
.18	35.1	18.7	4.99	10.52	3.11	—	—	—	6.0	58.3	4.33	94.0	95.5	0.48	93.3	0.71	88.8	84.4	
.66	44.9	11.6	3.53	7.54	2.48	12.5	75.3	4.32	27.7	85.4	2.39	59.8	94.8	0.88	89.8	1.73	75.9	62.7	
.67	47.9	10.2	3.61	6.74	2.59	11.2	61.0	6.81	9.9	80.4	3.18	78.9	94.2	0.99	89.1	1.86	83.7	76.6	
.85	36.7	12.2	3.31	7.86	2.25	17.8	16.7	1.95	34.0	33.8	2.96	48.2	94.0	1.40	59.8	2.03	59.7	50.0	
.44	30.5	16.5	4.51	9.69	2.99	—	—	—	5.3	62.9	3.00	94.7	95.5	0.66	93.7	0.78	85.0	80.2	
.26	18.6	13.4	3.85	7.29	2.45	11.5	21.3	2.67	18.3	79.3	3.35	70.2	94.9	0.98	83.6	1.61	80.2	72.8	
						4.0	21.9	3.61	7.2	73.8	3.16	88.8	95.2	0.73	90.7	1.02	79.5	81.0	

or Ash vs BTU values

TABLE
Results

Run	Time	Barrel #	Temp °C	pH	Air scfh	% Solids	MIBC gm/L	F.Oil #/ton
20	1015	4	12.5	8.2	4.0	18	0.011	—
20	1110	4	12.5	8.2	4.0	18	0.011	0.5
20	1155	4		8.2	4.0	18.5	0.011	0.5
21	1445	4	12	6.0	4.0	17.5	0.011	0.5
21	1540	4	12	5.9	4.0	17.5	0.011	0.5
22	945	4	16	8.0	4.0	17.5	0.011	0.33
22	1020	4	16	9.0	4.0	17.5	0.011	0.33
22	1050	4	16	10.0	4.0	17.5	0.011	0.33
23	1515	4	11.5	7.6	4.0	16.5	0.011	0.33
23	1535	4	11.5	7.0	4.0	16.5	0.011	0.33
23	1600	4	11.5	6.0	4.0	16.5	0.011	0.33
24	1000	4	14	7.8	4.0	15	0.011	0.33
24	1048	4	14	7.8	2.9	15	0.011	0.33
24	1120	4	14	7.8	2.0	15	0.011	0.33
25	1405	4	16.5	8.1	2.0	15.5	0.011	0.33
25	1440	4	16.5	8.1	4.0	15.5	0.011	0.33
25	1515	4	16.5	8.1	5.0	15.5	0.011	0.33
26	1000	5	14	8.0	4.0	15	0.011	0.33
26	1030	5	20	7.7	4.0	27.5	0.011	0.33
27	1145	5	15	7.9	4.0	15	0.011	0.33
27	1200	5	15	7.9	4.0	15	0.011	0.5
28	1420	5	17	8.0	4.0	15	0.011	0.5
28	1505	5	17	8.0	4.0	15	0.011	0.5
28	1550	5	17	8.0	4.0	15	0.011	0.7
29	955	5	15.5	7.7	4.0	11.5	0.011	0.5
29	1025	5	15.5	7.7	4.0	11.5	0.011	0.5
30	1207	5	17	8.0	4.0	32.5	0.011	0.5
32	1455	5	19	7.5	4.0	28.5	0.011	1.0
32	1525	5	19	7.5	4.0	21.7	0.011	1.21
37	Composite		12.5	7.7	4.0	20.5	0.011	0.5
41	950	6	12	7.5	4.0	20	0.011	0.5
42	1120	6			4.0	20	0.011	0.65

Operating Conditions

Feed

+28 Mesh			+48 Mesh			-48 Mesh				
% wt	% Ash	% S	% Wt	% Ash	% S	% Wt	% Ash	% S	Total % Ash	Total % S
8.0	24.7	1.78	42.3	20.8	2.03	47.9	30.4	2.75	28.9	2.37
4.9	8.33	1.55	31.8	6.72	1.56	63.3	26.4	2.36	19.3	2.07
9.8	30.7	2.23	45.0	20.5	2.43	45.2	31.2	3.18	26.3	2.75
8.5	20.7	1.95	39.1	18.2	2.19	52.4	37.2	3.01	28.4	2.60
5.1	15.5	1.39	30.5	6.87	1.45	64.4	29.2	2.05	21.7	1.83
7.5	17.2	1.68	38.5	17.1	2.83	54.0	36.0	2.91	27.3	2.79
6.5	5.35	1.65	33.7	8.05	1.68	59.8	31.4	2.41	21.8	2.11
4.1	5.42	1.36	31.6	3.94	1.39	64.3	25.4	2.16	17.6	1.88
2.3	36.6	1.86	30.2	13.4	1.78	67.5	31.1	2.55	25.9	2.29
1.4	19.2	1.65	32.7	10.0	1.63	65.9	30.5	2.30	23.6	2.07
—	—	—	25.6	4.95	1.40	74.4	23.3	1.69	18.6	1.62
3.1	24.1	2.16	36.6	14.5	1.81	60.3	32.0	2.41	24.6	2.18
8.3	13.5	1.65	37.3	12.0	1.85	54.4	30.9	2.36	22.4	2.11
--	--	-	11.8	5.65	1.31	88.2	17.9	1.30	16.5	1.30
2.7	14.1	1.60	43.5	9.20	1.68	53.8	30.7	2.22	20.9	1.97
5.6	15.2	1.72	40.1	9.80	1.62	54.3	29.5	1.83	20.8	1.74
3.3	8.28	1.43	32.9	4.88	1.41	63.8	21.6	1.66	15.7	1.57
5.0	20.4	2.04	49.2	10.0	2.08	45.8	31.4	2.54	23.6	2.19
5.9	12.0	1.67	44.6	11.2	1.82	49.5	29.6	2.30	20.4	2.15
5.6	28.9	1.87	48.3	20.5	2.40	46.4	35.4	2.90	27.8	2.60
4.3	22.9	1.86	41.8	12.9	1.90	53.9	32.1	2.62	23.7	2.29
3.4	22.4	1.82	42.0	12.1	2.06	54.6	34.8	2.56	26.8	2.31
7.2	18.2	1.94	42.6	12.9	1.90	50.2	31.7	2.52	22.7	2.21
5.8	8.22	1.83	43.1	10.6	1.92	51.1	29.6	2.31	20.2	2.11
4.4	20.3	1.60	37.6	11.0	1.64	58.0	32.0	2.50	23.6	2.14
3.2	11.5	1.74	35.6	7.14	1.58	61.2	28.9	2.24	20.8	1.99
5.6	6.48	1.55	34.8	6.21	1.47	59.6	27.7	1.98	19.0	1.78
8.9	7.89	1.50	41.2	6.86	1.49	49.9	28.6	1.90	17.8	1.70
6.4	6.29	1.47	40.4	6.20	1.43	53.2	24.5	1.81	15.9	1.64
5.1	13.5	1.66	43.2	14.2	1.89	51.7	32.2	2.15	23.5	2.01
9.1	17.8	1.71	39.0	15.2	1.87	51.9	35.7	2.37	28.1	2.12
6.2	10.0	1.65	35.6	7.90	1.57	58.2	31.1	2.11	20.5	1.89

Concentrat

+28 Mesh			+48 Mesh			
% Wt	% Ash	% S	% Wt	% Ash	% S	
9.7	4.42	1.72	62.1	4.61	2.30	2
7.6	4.39	1.65	46.4	9.35	2.10	4
8.3	3.00	1.80	53.1	6.00	2.37	3
0.8	2.61	1.19	58.8	6.25	2.33	4
2.8	3.04	1.17	48.9	3.43	1.63	4
9.2	2.93	1.76	60.1	8.61	2.02	3
11.6	2.88	1.63	54.8	8.21	2.56	3
6.7	2.27	1.33	51.2	4.67	1.84	4
1.7	3.86	1.51	56.4	4.97	2.04	4
--	—	—	35.1	4.38	1.70	4
—	—	—	28.6	7.46	1.41	7
2.9	4.56	1.72	65.1	8.34	2.48	3
8.3	3.21	1.69	59.7	7.02	2.08	3
3.5	2.78	1.35	45.2	3.56	1.52	5
2.4	3.32	1.60	59.4	5.81	1.78	3
8.2	3.11	1.68	56.5	6.68	2.08	3
6.1	4.50	1.35	52.5	3.07	1.54	4
8.8	2.75	1.76	68.3	7.01	2.39	3
9.0	3.04	1.79	65.5	9.49	2.64	2
4.1	3.52	1.76	66.7	7.14	2.67	2
4.0	3.95	1.90	59.5	8.95	2.87	3
4.1	3.65	1.84	68.2	10.3	3.36	2
6.9	3.20	1.81	60.9	7.22	2.43	3
9.2	3.02	1.81	57.8	5.50	2.22	3
5.3	3.32	1.65	52.1	6.03	2.24	4
5.9	3.15	1.74	49.4	4.37	1.82	4
4.6	2.31	1.24	57.2	3.37	1.55	3
10.4	2.94	1.53	64.6	6.11	1.78	2
9.4	3.80	1.61	49.8	5.80	1.74	4
8.2	2.91	1.67	69.8	8.91	2.38	2
8.1	3.32	1.77	75.1	10.7	3.00	1
7.4	2.81	1.51	61.2	6.85	2.14	3

See TABLE III for Ash

BLE I

SULTS

| Concentrate | | | | | | Tailings | | | | | |

LA VILLE DE québec
Service de l'Aqueduc
Division des laboratoires
2480, de la Canardière
Québec G1J 2G1

EAU DE LA VILLE DE QUÉBEC
CARACTÉRISTIQUES MOYENNES

Date : 14 janvier 1982

Période : DECEMBRE 1981

Notre référence : 36-194

TABLE II

Water Analysis

Paramètre	Eau brute*	Eau claire**
Couleur (UPC)	30	10
Turbidité (UNT)	2,3	1,3
pH	7,0	7,2
Alcalinité tot. (mg/l $CaCO_3$)	15	19
Dureté (mg/l $CaCO_3$)	28	38
Chlorure (mg/l Cl)	18	19
Sulfate (mg/l SO_4)	5	5
DCO (mg/l O_2)	1,6	0,8
Chlore rés. tot. (mg/l Cl_2)	–	0,2
Température (C)	1	1
Calcium (mg/l Ca)	8,3	11,8
Cuivre (mg/l Cu)	0,03	<0,01
Fer (mg/l Fe)	0,54	0,35
Magnésium (mg/l Mg)	1,75	1,8
Potassium (mg/l K)	0,9	0,95
Sodium (mg/l Na)	8,9	9,3
Fluorure (mg/l F)	0,10	1,15
Nitrate (mg/l N)	–	0,01
Phosphore (ortho) (mg/l P)	0,01	–
Phosphore (hydr) (mg/l P)	–	0,065
Phosphore (org) (mg/l P)	–	–
Silice (mg/l SiO_2)	8,3	9,0
Conductivité (µmhos/cm)	120	140
NMG (35°C) (col/ml)	230	2
NMG (20°C) (col/ml)	1 200	1
Bact. colif. tot. (MPN/100 ml)	970	<2
Bact. colif. féc. (col/100 ml)	50	<1
Pseudomonas (col/100 ml)	69	<2
Streptocoques (col/100 ml)	51	<2
Staphylocoques (col/100 ml)	<2	<2

* Eau de la rivière St-Charles à la prise d'eau de la ville de Québec

** Eau du bassin d'eau claire à l'usine de traitement de la ville de Québec, sauf pour les mesures de chlore résiduel total (poste Verdun) et de phosphore (poste Ventun)

Pierre-A. Côté, D.Sc., chim.
Chef, Division des Laboratoires

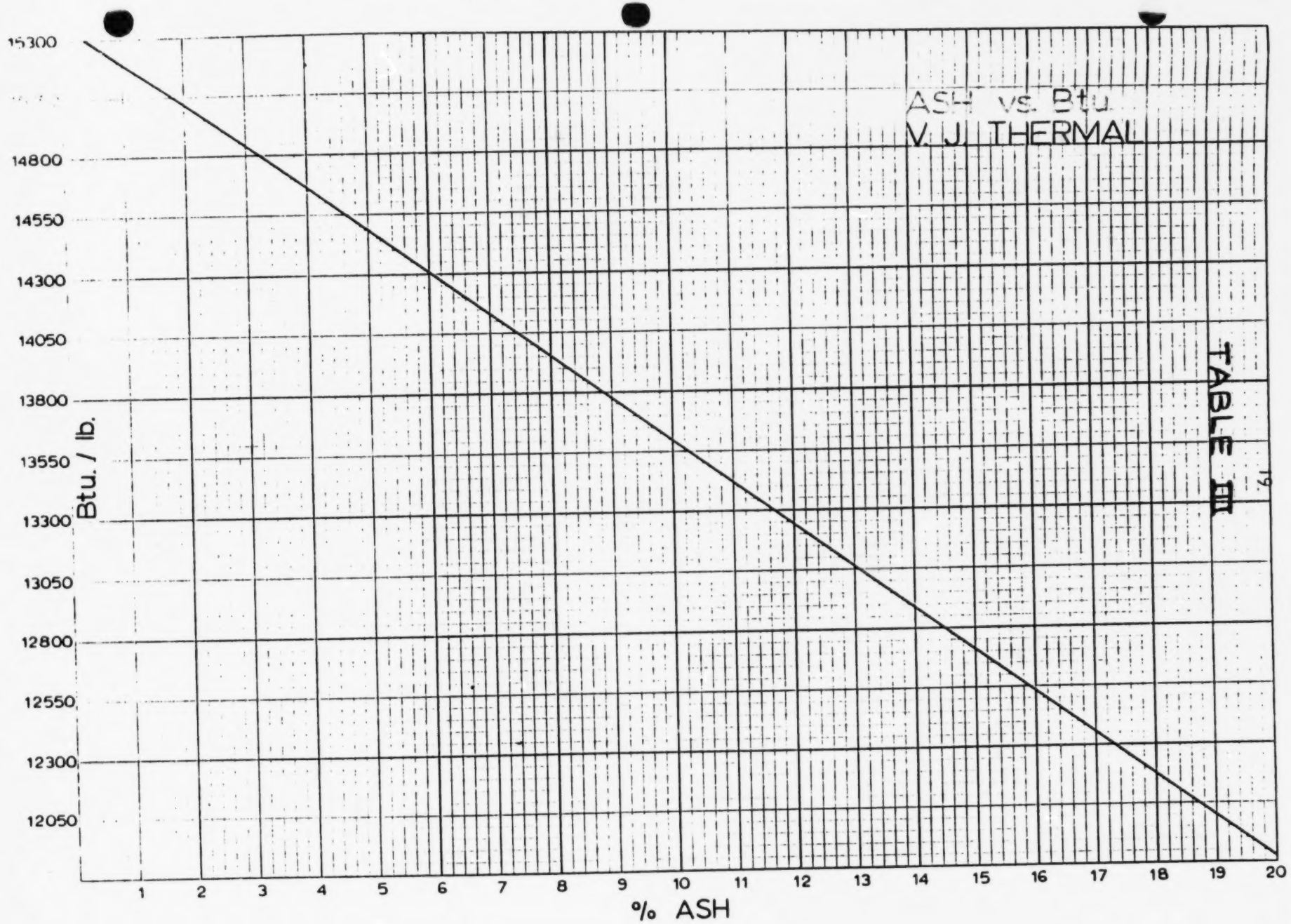

ASH vs. Btu.
V. J. THERMAL
TABLE III
Btu. / lb.
15300
14800
14550
14300
14050
13800
13550
13300
13050
12800
12550
12300
12050
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
% ASH

TABLE IV

EFFECT OF SECONDARY INTERFACE ON RECOVERY

Run	Time	TAILING +28 Mesh % Wt	+28 Mesh % Ash	+48 Mesh % Wt	+48 Mesh % Ash	-48 Mesh % Wt	-48 Mesh % Ash	Total Ash	
9	1015	0.2	----	67.4	26.7	32.4	60.5	37.6	Secondary interface out the bottom
9	1040	0.2	----	6.8	76.3	93.0	91.0	89.8	Added fuel oil, secondary interface reappeared at bottom of column and moved up to join the primary interface in the cleaning section.
10	1400	14.0	55.0	36.5	80.0	49.5	90.9	81.9	Secondary interface descending
10	1405	14.0	16.8	66.7	35.2	19.3	79.4	41.5	Secondary interface out the bottom
10	1435	7.5	17.0	9.9	64.9	82.6	91.2	83.0	Added fuel oil, secondary interface reappeared at bottom of column and moved up to join the primary interface in the cleaning section
12	1505	15.7	4.3	49.7	10.4	34.6	76.8	32.5	Secondary interface out the bottom
14	1430	9.3	73.1	24.8	84.8	65.9	94.9	90.3	Secondary Interface descending
14	1445	15.5	7.4	48.2	31.9	36.3	77.6	44.8	Secondary interface out the bottom
14	1510	1.8	74.8	11.4	84.8	86.8	95.1	93.5	Added fuel oil, secondary interface reappeared at the bottom of column and moved up to join the primary interface in the cleaning section.

TABLE V

FEED STRUCTURES

Mesh	Barrel #1	Barrel #2	Barrel #3	Barrel #4	Barrel #5
+ 28	6.6	6.5	13.6	12.2	12.1
+ 48	36.4	34.5	35.5	35.3	34.1
+ 65	14.6	16.0	10.2	13.2	13.6
+100	13.1	12.2	12.0	13.5	12.9
+150	10.1	10.8	8.2	8.8	9.4
+200	5.7	5.8	3.8	3.6	1.8
+270	0.9	1.5	1.6	0.9	2.0
+325	0.6	0.2	1.0	0.8	1.0
-325	12.0	12.5	14.1	11.7	13.1
	100.0	100.0	100.0	100.0	100.0

TABLE VI

FEED ASH

Mesh	Barrel #1 % Ash	Barrel #2 % Ash	Barrel #3 % Ash	Barrel #4 % Ash	Barrel #5 % Ash
+ 28	31.6	30.4	77.8	29.5	20.6
+ 48	27.7	22.6	85.8	27.6	24.5
+ 65	32.8	21.7	71.8	20.0	19.9
+100	26.7	22.5	38.6	30.8	27.9
+150	34.7	31.1	30.2	32.2	30.0
+200	43.3	41.0	29.1	35.3	34.8
+270	50.6	51.9	16.8	67.9	63.7
+325	52.9	53.9	23.3	80.0	50.7
-325	49.2	48.2	22.3	52.2	53.7
	32.6	28.7		31.6	29.6

TABLE VII

EFFECT OF FEED DENSITY

Run	Time	% Solids	Feed % Ash	Conc % Ash	Tail % Ash	Yield %
29	1025	11.5	20.8	8.34	86.0	84.0
28	1505	15	22.7	9.32	88.4	83.1
32	1525	21.7	15.9	7.86	91.7	90.4
32	1455	28.5	17.8	6.97	90.9	87.1
30	1207	32.5	19.0	4.68	88.3	82.9

TABLE VIII

EFFECT OF pH ON TAILS

Run	Time	pH	Tailing				
			+28 % Ash	+48 % Ash	-48 % Ash	Total % Ash	Yield or % Wt Floated
23 *	1535	7.0	43.9	71.4	90.0	84.6	78.3
23	1600	6.0	7.7	15.1	71.8	38.2	60.7
11	1145	2.7	6.3	11.1	78.8	31.9	39.3

* Normal tailings

TABLE IX

EFFECT OF FLOTATION AIR

Run	Time	Air scfh	Feed % Ash	Conc % Ash	Tail % Ash	Yield %
24	1000	4.0	24.6	10.52	89.2	83.4
24	1048	2.9	22.4	9.26	89.1	83.5
24	1120	2.0	16.5	6.00	91.0	87.6
25	1405	2.0	20.9	7.43	89.8	83.6
25	1440	4.0	20.8	8.58	85.3	84.1
25	1515	5.0	15.7	4.27	87.6	86.3

TABLE X

EFFECT OF CAPACITY

Run	Time	Feed ml/min	Feed % Ash	Conc % Ash	Tail % Ash	Yield %
28	1420	900	24.8	12.88	86.7	83.9
28	1505	1080	22.7	9.32	88.4	83.1
28	1550	1470	20.2	7.49	90.6	84.7

TABLE XI

PYRITIC SULPHUR FLOAT

Run	Time	Temp °C	pH	Air scfh	% Solid	PAX #/ton	633 #/ton	MIBC gm/L	-48 Mesh	Wt gm/min	% S	% Recovery Assay	% Recovery Wt-Assay
38A	1135	18	7.0*	4.0	10.5	1.0	0.5	0.0028	Feed		2.88		
									Conc	11.45	1.82		
									Tail	57.14	4.65	60.5	93.0
39	1350	17	7.0	4.0	10.5	0.85	0.75	0.0028	Feed		3.65		
									Conc	30.4	1.94		
									Tail	3.08	4.84	78.2	20.2
39	1415	17	7.0	4.0	10.5	1.0	0.85	0.0028	Feed		3.65		
									Conc	18.4	1.55		
									Tail	6.53	11.1	66.9	71.8
40	1520	20	7.5	4.0	20.5	0.85	0.75	0.0028	Feed		3.45		
									Conc	36.75	1.96		
									Tail	9.4	4.79	73.1	38.5
40	1540	20	7.5	4.0	20.5	1.0	0.75	0.0028	Feed		2.42		
									Conc	32.75	1.56		
									Tail	20.1	3.86	59.6	61.2

* pH electrode was broken in Run 38A. Actual pH was between 5.0 and 5.5

POOR

QUALITY

ORIGINAL